

REMARKS

Claim 31 has been cancelled without prejudice, since the recitations in Claim 31 have been inserted into Claim 30. Claims 2 and 12 have been amended to correct an original typographical error in which some of the claim language was repeated. Claims 7, 17, 25, and 30 have been amended, and new dependent Claims 61 - 65 added in order to more fully claim specific embodiments of applicants' invention. Support for the new dependent claims and the claim amendments to Claims 7, 17, and 25, is found, for example, at Page 22, line 15, through Page 25, line 26, of applicants' Specification as originally filed. Support for the amendment of Claim 30 is found at Page 15, lines 19 - 25, in combination with Page 17, lines 12 - 21, of the Specification, and in original Claim 31.

The Notice of Non-Compliant Amendment mailed April 8, 2004, states that "Claim 31 shouldn't show text". This Revised Amendment "A" is identical to applicant's original Amendment "A", except that the text of cancelled Claim 31 has been deleted.

Applicants are submitting a "Declaration Of Prior Invention" Under 37 C.F.R. § 1.131 to swear behind U.S. Patent No. 6,559,001, the Athavale et al. reference, which is cited under 35 U.S.C. § 102 (e)(2). Applicants' attorney was able to obtain the signatures of four of the five inventors. However, the fifth inventor, Jeng H. Hwang, has relocated to Taiwan, and we were unable to obtain a forwarding address, telephone number, or e-mail address for him.

Claim Objections

Claims 2 and 12 are objected to due to an informality. In particular, the Examiner observes that, in line 3 of Claims 2 and 12, the term "prior to" is repeated twice. The Examiner suggests deleting one of the occurrences of "prior to". Claims 2 and 12 have been amended in accordance with the Examiner's suggestion, as set forth above.

In light of the amendments to Claims 2 and 12, applicants respectfully request withdrawal of the objections to Claims 2 and 12.

Claim Rejections Under 35 USC § 102

Claims 1 - 4, 6, and 27 - 29 are rejected under 35 USC § 102(e) as being anticipated by U.S. Patent No. 6,559,001, to Athavale et al.

Applicants are submitting a Declaration of Prior Invention Under 37 C.F.R. § 1.131, to show invention prior to the effective date of the Athavale et al. reference under 35 U.S.C. § 102(e). Since the reference cited is a patent, the reference would fall under 35 U.S.C. § 102(e)(2), which recites a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent. Applicants' Declaration, with attached supporting evidence, shows that the subject matter disclosed in the Athavale et al. reference was known to the inventors more than 6 months prior to the May 30, 2001 filing date of the Athavale et al. patent application, based on an invention alert for the parent application to the present Continuation-In-Part application.

In view of the removal of the Athavale et al. patent as an effective prior art reference, applicants respectfully request withdrawal of the rejection of Claims 1 - 4, 6, and 27 - 29 under 35 USC § 102(e), over the Athavale et al. reference.

Claim Rejections Under 35 USC § 103

Claims 5, 7, and 8 are rejected under 35 USC § 103(a) as being unpatentable over Athavale et al., in view of U.S. Patent No. 5,877,032, to Guinn et al.

The Athavale et al. reference is not citable as an effective reference against applicants' claimed invention, as discussed in detail above, with respect to the rejection of Claims 1 - 4, 6, and 27 - 29 under 35 USC § 102(e).

The Guinn et al. reference does not relate to the seasoning of a plasma etch chamber. Further, the Guinn et al. reference pertains to a process for device fabrication in which a pattern is transferred from a photoresist mask into an underlying layer of silicon dioxide, using a plasma containing a fluorocarbon gas. The plasma is monitored using optical emission spectroscopy, monitored at selected wavelengths, to effect control of the etch process. (Abstract)

The Guinn et al. reference does not discuss the etching of an iridium layer, and does not mention the presence of involatile etch by-products which cause problems during the etching of subsequent device-containing substrates, as described by applicants. The Guinn et al. reference does not suggest any method of preventing iridium etch byproducts from contaminating substrates subsequently etched in the same process chamber, as claimed by applicants.

There is no common subject matter with respect to the material which is being etched. One skilled in the art will recognize that the problems with the non-volatility of iridium etch byproducts does not exist with respect to the etch byproducts of silicon dioxide, and thus would not use the Guinn et al. reference for guidance as to how to solve the problem which has been solved by applicants' invention.

The Guinn et al. reference does not teach or even suggests applicants' claimed invention. In light of the above, applicants respectfully request withdrawal of the rejection of Claims 5, 7, and 8 under 35 USC § 103(a), over Athavale et al., in view of Guinn et al.

Claims 9 and 10 are rejected under 35 USC § 103(a) as being unpatentable over Athavale et al., in view of U.S. Patent No. 6,090,718, to Soga et al.

The disclosure provided in the Athavale et al. reference is not citable as an effective reference against applicants' claimed invention. This is discussed in detail above, with respect to the rejection of Claims 1 - 4, 6, and 27 - 29 under 35 USC § 102(e).

Applicants respectfully contend that the Soga et al. reference not only does not suggest applicants' invention, but teaches away from applicants' invention. The Soga et al. reference teaches a method of removing reaction product which collects on processing chamber surfaces from previous semiconductor substrate. Applicants teach trapping of the reaction products on the process chamber surface.

In more detail, the Soga et al. reference pertains to a method of cleaning a processing chamber after the performance of a silicon etch process in the chamber “. . . including the steps of etching the silicon substrate, etching a reaction product produced in the step of etching the silicon substrate, and further etching the silicon substrate. Before the step of etching the reaction product, the silicon substrate is taken out from an etching chamber and alternately a dummy substrate is introduced into the etching chamber. The silicon substrate that is etched after the step of etching the reaction product may be a silicon substrate different from the substrate etched before the step of etching the reaction product. A silicon substrate having an SiO₂ layer on a surface thereof can be used as the dummy substrate. Preferably, the step of etching the reaction product includes a cleaning step for etching the reaction product, and a seasoning step for removing the reaction product from the etching chamber and adjusting an atmosphere within the etching chamber and a temperature of the dummy substrate. The cleaning step may further include a first cleaning step performed at a first pressure and a second cleaning step performed at a second pressure different from the first pressure. More preferably, the step of etching the reaction product includes a purge step for removing foreign materials suspended within the etching chamber, attached to the substrate, or the like, without generating plasma within the etching chamber. The purge step can be performed after the seasoning step.” (Col. 3, lines 6 - 32) The Soga et al. reference does not even suggest applicants' invention, which discloses a seasoning method which creates a layer of material on the process chamber surface which entraps and/or adheres non-volatile contaminant particles generated during methal etch processes carried out prior to and subsequent to the seasoning process. Please see, for example, applicants' “Summary of the Invention”, Page 4, lines 20 - 25, continuing at Page 5, lines 1 and 2;

and Page 6, lines 9 - 13. The metal etch particulates described in several of applicants' embodiments are the result of etching a layer of iridium, as described at Page 6, lines 21 - 25.

In light of the above distinctions, applicants respectfully request withdrawal of the rejection of Claims 9 and 10 under 35 USC § 103(a), over Athavale et al., in view of Soga et al.

Claims 11 - 14, 16, 19 - 22, and 24 are rejected under 35 USC § 103(a) as being unpatentable over Athavale et al., in view of Soga et al.

Again, the Athavale et al. reference is not an effective reference against applicants' disclosure. The deficiencies of the disclosure of Soga et al. with respect to the patentability of the present invention are discussed in detail above, with respect to the rejection of Claims 9 and 10 under 35 USC § 103(a). Although Claim 11 pertains to a method of forming a storage capacitor in a plasma etch chamber, it incorporates the elements of seasoning the etch chamber which were discussed with respect to Claims 9 and 10.

Further, the Soga et al. reference pertains to a method of cleaning a processing chamber after etching of a trench in a silicon substrate within the chamber. Soga et al. does not pertain to a method of forming a storage capacitor, in which non-volatile iridium layers are etched, as claimed by applicants. The Soga et al. reference does not teach or even suggest applicants' invention as claimed in Claims 11 - 14, 16, 19 - 22, and 24.

In light of the above, applicants respectfully request withdrawal of the rejection of Claims 11 - 14, 16, 19 - 22, and 24 under 35 USC § 103(a), over Athavale et al., in view of Soga et al.

Claims 15, 17, 18, 23, 25, and 26 are rejected under 35 USC § 103(a) as being unpatentable over Athavale et al., in view of Soga et al., and further in view of Guinn et al.

The Athavale et al. reference is not an effective reference against applicants' disclosure, as discussed in detail above, with respect to the rejection of Claims 1 - 4, 6, and 27 - 29 under 35 USC § 102(e). The deficiencies of the disclosure of Soga et al. with respect to the patentability of the

present invention are discussed in detail above, with respect to the rejection of Claims 9 and 10 under 35 USC § 103(a). The deficiencies of the disclosure of Guinn et al. with respect to the patentability of the present invention are discussed in detail above, with respect to the rejection of Claims 5, 7, and 8 under 35 USC § 103(a).

Even if one were to combine the disclosures of Soga et al. and Guinn et al., one skilled in the art would not be led toward applicants' claimed invention. Whether taken alone or in combination, neither the Soga et al. reference, nor Guinn et al. reference teaches or even suggests applicants' claimed invention.

In light of the above, applicants respectfully request withdrawal of the rejection of Claims 15, 17, 18, 23, 25, and 26 under 35 USC § 103(a), over Athavale et al., in view of Soga et al., and further in view of Guinn et al.

Claims 30 - 37 are rejected under 35 USC § 103(a) as being unpatentable over Athavale et al., in view of U.S. Patent No. 6,350,697, to Richardson et al.

Claims 30 - 37 claim a chamber seasoning method in which a substrate specially designed to provide a source of entrapment or adhering material is disposed within the chamber. The chamber walls, and internal apparatus surfaces of the plasma etch chamber are exposed to a seasoning plasma generated from a source gas that includes at least one principal etchant gas used during a noble metal etch process which produced the nonvolatile etch byproducts which are causing contamination. The plasma-based seasoning process is carried out at a substrate temperature that is equal to or greater than a substrate temperature at which the nonvolatile etch byproducts were produced. Exposure of the substrate to the seasoning plasma generates an entrapment and adhering material which adheres the nonvolatile noble metal etch byproducts to chamber walls and to internal apparatus surfaces.

The Athavale reference is not an effective reference against applicants' disclosure, as discussed above, with respect to the rejection of Claims 1 - 4, 6, and 27 - 29 under 35 USC § 102(e).

Applicants respectfully contend that the Richardson et al. reference teaches away from the use of a special substrate presence during the conditioning of a processing chamber. In the Richardson et al. preferred embodiment, there is no substrate present in the processing chamber until after the conditioning is carried out. In a less preferred embodiment, there is a substrate in the process chamber during conditioning, but it is specifically a production wafer and not a specialized conditioning wafer. (Col. 2, lines 33 - 37.)

All of the embodiments in the Richardson et al. disclosure pertain to the etching of aluminum layers in the process chamber. It is well known in the art that aluminum etch by-products are highly volatile in comparison to the noble metal etch by-products which applicants' seek to alleviate the effect of in their invention as claimed in Claims 30 - 37.

In light of the above, applicants respectfully request withdrawal of the rejection of Claims 30 - 37 under 35 USC § 103(a), over Athavale et al., in view of Richardson et al.

Claims 38 - 51, 56, 57, and 59 are rejected under 35 USC § 103(a) as being unpatentable over U.S. Patent No. 5,411,631, to Hori et al., in view of Athavale et al.

The Athavale et al. et al. reference is not an effective reference with respect to applicants' disclosure, as discussed above.

Applicants respectfully contend that the Hori et al. reference does not render applicants' disclosure obvious. The Hori et al. reference does not relate to and does not even suggest a method of seasoning a process chamber. The Hori et al. reference pertains to a two step method for etching an Al-Si-Cu thin film, where the film is etched by RIE in the first step and etching residues are removed from the etched surface by a sputter effect obtained in a second plasma treatment step. (Abstract and Col. 3, lines 19 - 30) One skilled in the art would not be drawn to the Hori et al. reference with respect to solving applicants' problem related to the build up of noble metal particulates in an etch processing chamber.

Hori et al. does not teach or even suggest a method of seasoning a plasma etch chamber in order to prevent particulates generated from noble metal etch byproducts from adversely affecting an etch process which is subsequently performed in the plasma etch chamber, as disclosed and claimed by applicants.

In light of the above, applicants respectfully request withdrawal of the rejection of Claims 38 - 51, 56, 57, and 59 under 35 USC § 103(a), over Hori et al., in view of Athavale et al.

Claims 52 and 53 are rejected under 35 USC § 103(a) as being unpatentable over Hori et al., in view of Athavale et al., and further in view of Guinn et al.

As previously discussed, the Athavale et al. reference is not an effective reference against applicants' disclosure. The general deficiencies of the disclosure of Guinn et al. with respect to the patentability of the present invention are discussed in detail above, with respect to the rejection of Claims 5, 7, and 8 under 35 USC § 103(a). The general deficiencies of the disclosure of Hori et al. with respect to the patentability of the present invention are discussed in detail above, with respect to the rejection of Claims 38 - 51, 56, 57, and 59 under 35 USC § 103(a).

Claims 52 and 53 depend from independent Claim 48. Applicants maintain that Claims 52 and 53 are patentable over the combination of the Hori et al. and Guinn et al. for the same reasons that Claim 48 is patentable over these references, as discussed above.

In view of the above discussions, applicants respectfully request withdrawal of the rejection of Claims 52 and 53 under 35 USC § 103(a), over Hori et al., in view of Athavale et al., and further in view of Guinn et al.

Claims 54, 55, 58, and 60 are rejected under 35 USC § 103(a) as being unpatentable over Hori et al., in view of Athavale et al., and further in view of U.S. Patent No. 5,789,867, to Westendorp et al.

Claims 54 - 60 relate to particular relative amounts of plasma source gas materials which are used to form a seasoning plasma. These claims depend either directly or indirectly from Claim 48.

The Athavale et al. reference is not a citable effective reference against applicants' disclosure for the reasons previously presented. The deficiencies of the disclosure of Hori et al. with respect to the patentability of the present invention are discussed in detail above, with respect to the rejection of Claims 38 - 51, 56, 57, and 59 under 35 USC § 103(a).

The Westendorp et al. reference pertains to an apparatus and method for improving the ignition of a plasma within a process module. There is no description in the Westendorp et al. reference which relates to process chamber seasoning, or to the etching of noble metal electrodes. The Examiner has cited Westendorp et al. as disclosing a method for igniting plasma comprising the steps of generating a plasma mixture including Cl₂, N₂, and argon.


Since the Hori et al. reference does not relate to a method of seasoning a process chamber, and does not discuss the etching of noble metal electrodes, and since the Westendorp et al. reference is not related to this subject matter, a combination of these references does not direct one skilled in the art toward applicants' invention as claimed in Claims 54, 55, 58, and 60. In light of the above, applicants respectfully request withdrawal of the rejection of Claims 54, 55, 58, and 60 under 35 USC § 103(a), over Hori et al., in view of Athavale et al., and further in view of Westendorp et al.

The Examiner is respectfully requested to withdraw the rejection of Claims 54 - 60 under 35 USC § 103(a) as being unpatentable over Hori et al., in view of Athavale et al., and further in view of U.S. Patent No. 5,789,867, to Westendorp et al.

Applicants contend that all presently pending claims are in condition for allowance, and the Examiner is respectfully requested to enter the present amendments and to pass the application to allowance.

The Examiner is invited to contact applicants' attorney with any questions or suggestions, at the telephone number provided below.

Respectfully Submitted,

A handwritten signature in cursive script that reads "Shirley L. Church". The signature is written in black ink and is positioned above the printed name.

Shirley L. Church
Registration No. 31,858
Attorney for Applicants
(650) 473-9700

Correspondence Address:
Patent Counsel
Applied Materials, Inc.
P.O. Box 450 A
Santa Clara, CA 95052